

29TH SEPTEMBER 1987

General Notes

Component reference numbers are as indicated in the attached component overlay, which replaces diagrams of earlier date.

(All pin assemblies have pin 1 towards the top (North) or the left hand side (West) of the board, viewed on side B in "landscape", as opposed to "portrait" position.)

Pin Assemblies

P1

Connect this pin assembly to a 3-position SPDT Centre Off toggle switch on front panel. The front panel switch is mounted towards the left edge of the card front and is to be called "S2". P1 pin 1 goes to the top connection of the switch, P1 pin 2 goes to the centre connection, P1 pin 3 to the bottom connection.

Remarks on the function of S2 are given later under the heading "Switches"

P2

Connect this pin assembly to a 2-position SPDT (or DPDT used as SPDT) toggle switch on front panel. The front panel switch is mounted towards the right hand edge of the card front and is to be called "S3". P2 pin 1 goes to the top connection of the switch, P2 pin 2 goes to the centre connection, P2 pin 3 to the bottom connection.

Remarks on the function of S3 are given later under the heading "Switches"

P3, P7

These should be fitted with push fit shorting jumper links ("Jlinks") as follows:

P3 pins 1-2, P7 pins 1-2: This is the preferred Interak 1 arrangement. It allows the VDU-2K card to be adjusted for "snow free" operation, provided there is RAM available in the system at the same address as that to which the VDU-2K is set. In this mode the VDU-2K is "write only"; a read of a location in the VDU-2K area will be serviced by the system RAM at the same address, the VDU-2K on board RAM is not accessed at all for CPU reads. (This is part of the principle which is used to achieve the "snow free" operation.)

P3 pins 2-3, P7 pins 2-3: These are non-preferred settings. Use these if there is no RAM available in the

system at the same address as that to which the VDU-2K is set. The VDU-2K board now will respond to both read and write requests by the system CPU; the penalty for this is that the board can no longer be adjusted for "snow free" operation.

P4

This is not required. Pins 1 and 2 of this assembly are linked in the track on side A of the board. (P4 is provided to allow the use of other EPROM types in the Timing Generator Socket U3.)

P5

The settings here depend on the type of Timing Generator EPROM which is supplied for use in the U3 socket (note that the 2716 referred to below is the common "5 Volt" type, not the Texas TMS 2716 which is unsuitable for use on this board):

2516	(2K 24-pin)	Link P5 pins	1-2 and 4-5
2716	(2K 24-pin)	Link P5 pins	1-2 and 4-5
2532	(4K 24-pin)	Link P5 pins	1-2 and 3-4
2732	(4K 24-pin)	Link P5 pins	2-3 and 4-5
2764	(8K 24-pin)	Link P5 pins	2-3 and 4-5

The most commonly used EPROM for the Timing Generator at the time of writing is the 2764 so the usual setting on P5 is P5 pins 2-3 and pins 4-5.

If a 24 pin EPROM is supplied it must be mounted in the 28 pin socket so that pins 1,2,27,27 of the socket are empty, ie mount U3 as far South as it will go.

P6

This pin assembly alters the "snow free" circuitry to suit different CPU clock speeds. (It alters the timing on a monostable in U4, which alters a particular delay):

System Clock less than 6 MHz	Link P6 pins 1-2
System Clock 6 MHz or greater	Link P6 pins 2-3

The normal Interak 1 system has a system clock less than 6 MHz thus the normal setting for P6 is to link pins 1-2.

P7

This has already been discussed, in conjunction with P3 above.

P8, P9, P11

These allow the format of the VDU-2K display to be either 32 characters per row or 64 characters per row:

The details are as given in the following tables, but most users will find it easier to use the diagram which is given below the tables.

64 characters	32 characters
Link P11 pins 1-2	Link P11 pins 2-3
and:	and:
P8 pin 1 - P9 pin 1	P8 pins 2-3
P8 pin 2 - P9 pin 2	P8 pins 4-5
P8 pin 3 - P9 pin 3	P8 pins 6-7
P8 pin 4 - P9 pin 4	P9 pins 1-2
P8 pin 5 - P9 pin 5	P9 pins 3-4
P8 pin 6 - P9 pin 6	P9 pins 5-6
64 characters	32 characters



The settings on the three pin assemblies P16, P17, P18 alter the circuit on the board to suit the particular types of Character Generator EPROM which is supplied for use in the U24 socket (note that the 2716 referred to below is the common "5 Volt" type, not the Texas TMS 2716, which is unsuitable for use on this board):

	P16	P17	P18
	-----P16-----		
2516 (2K 24-pin)	[2-3][4-5] 6-7	[1-2]	1-2
2716 (2K 24-pin)	[2-3][4-5] 6-7	[1-2]	1-2
2532 (4K 24-pin)	[1-2][3-4] 5-6	[1-2]	1-2
2732 (4K 24-pin)	[2-3] 4-5 6-7	[1-2]	2-3
2764 (8K 24-pin)	2-3 4-5 6-7	1-2	2-3

Connections in square brackets indicate links which are not functional connections, merely places to "park" the surplus JLinks.

The most commonly used EPROM for the Character Generator at the time of writing is the 2764 so the usual settings are as given on the last line of the table above.

If a 24 pin EPROM is supplied it must be mounted in the 28 pin socket so that pins 1,2,27,27 of the socket are empty, ie mount U24 as far East as it will go.

P19

The settings on the P19 pin assembly alters the circuit on the board to suit the particular types of Video RAM chip which may be supplied for use in the U27 socket

2K 24-pin eg 6116	Link P19 pins 1-2
8K 28-pin eg 6264	Link P19 pins 2-3

If a 24 pin RAM is supplied it must be mounted in the 28 pin socket so that pins 1,2,27,27 of the socket are empty, ie mount U27 as far East as it will go.

Switches

There are 3 switches generally used to control the functions of the VDU-2K. S1 is a 16-pin (8 x SPST) DIL switch mounted in a socket towards the North East corner of the board. S1 is a 3 position SPDT centre off toggle switch mounted to the upper left of the front panel, and S3 is a 2 position SPDT toggle switch mounted to the upper right of the front panel.

S1 switches 1-5 (a-e)

The first 5 elements of S1 select the starting address of the RAM on the VDU card. The RAM is constrained to occupy only 2K of space in the system regardless of

the size of RAM chip used in position U27 (ie only 2K of an 8K RAM chip would be used).

In its 32-character per row mode the VDU-2K uses about 0.75K of RAM, and double this quantity in 64-character per row mode. The remaining space to 2K is vacant for the users own purposes, eg to set up lines below the bottom of the screen, which can be scrolled up instantly.

The settings of the first 5 switches of the VDU-2K for all possible addresses are as follows:

Address	S1-1	S1-2	S1-3	S1-4	S1-5
0000H-07FFH	OFF	OFF	OFF	OFF	OFF
0800H-0FFFH	OFF	OFF	OFF	OFF	ON
1000H-17FFH	OFF	OFF	OFF	ON	OFF
1800H-1FFFH	OFF	OFF	OFF	ON	ON
2000H-27FFH	OFF	OFF	ON	OFF	OFF
2800H-2FFFH	OFF	OFF	ON	OFF	ON
3000H-37FFH	OFF	OFF	ON	ON	OFF
3800H-3FFFH	OFF	OFF	ON	ON	ON
4000H-47FFH	OFF	ON	OFF	OFF	OFF
4800H-4FFFH	OFF	ON	OFF	OFF	ON
5000H-57FFH	OFF	ON	OFF	ON	OFF
5800H-5FFFH	OFF	ON	OFF	ON	ON
6000H-67FFH	OFF	ON	ON	OFF	OFF
6800H-6FFFH	OFF	ON	ON	OFF	ON
7000H-77FFH	OFF	ON	ON	ON	OFF
7800H-7FFFH	OFF	ON	ON	ON	ON
8000H-87FFH	ON	OFF	OFF	OFF	OFF
8800H-8FFFH	ON	OFF	OFF	OFF	ON
9000H-97FFH	ON	OFF	OFF	ON	OFF
9800H-9FFFH	ON	OFF	OFF	ON	ON
A000H-A7FFH	ON	OFF	ON	OFF	OFF
A800H-AFFFH	ON	OFF	ON	OFF	ON
B000H-B7FFH	ON	OFF	ON	ON	OFF
B800H-BFFFH	ON	OFF	ON	ON	ON
C000H-C7FFH	ON	ON	OFF	OFF	OFF
C800H-CFFFH	ON	ON	OFF	OFF	ON
D000H-D7FFH	ON	ON	OFF	ON	OFF
D800H-DFFFH	ON	ON	OFF	ON	ON
E000H-E7FFH	ON	ON	ON	OFF	OFF
E800H-EFFFH	ON	ON	ON	OFF	ON
F000H-F7FFH	ON	ON	ON	ON	OFF
F800H-FFFFH	ON	ON	ON	ON	ON

To suit Interak 1 (which locates the VDU at address F000H onwards) the top 5 elements of DIL switch S1 should be ON ON ON ON OFF respectively.

S1 switches 6-8 (f-h)

The last 3 elements of S1 can be used to select different format options from the VDU-2K timing generator. Their precise function is variable as it depends on the size and contents of the Timing Generator EPROM plugged into T3, but a typical use might be as follows:

(You can operate the lower three elements of DIL switch S1 without damage to the VDU-2K whilst it is operating, however be prepared for a "crash" in the program running in the Timing Generator EPROM. In case of doubt switch off, wait a few seconds and on restoring power the Timing Generator will initialise correctly)

- S1-6 (f) ON No Function (timing program) at present, leave this switch ON
- OFF Illegal position, prevents VDU-2K from functioning in EPROMs greater than 4K which have no program beyond 4K.

S1-7 (g) ON Display will be interlaced

OFF Display will be non-interlaced

S1-8 (h) ON Front panel switch (if connected to P2) will allow switching between 24 and 25 rows of characters

OFF Front panel switch S3 (if connected to P2) will allow switching between 16 and 24 rows of characters

The settings recommended at present for the lower 3 switches of DIL switch S1 are that they should all be ON.

Front Panel Switch S2

The precise function of S2 depends on the size and contents of the Character Generator EPROM which has been supplied for use in position U24. A typical use is that S2 selects one of the available 3 alternative character sets. (An "alternative" character set is the set of characters which appear when the byte written to the VDU for display has its high bit set.) With the character generator we supply at the time of writing the 3 positions are:

- Up Alternative characters are inverse video versions of the existing 128 "standard" (ASCII mainly) characters.

Centre Alternative Characters are chess pieces to suit the 64-column VDU-2K screen.

Down This is left blank for the user's own characters, and in the EPROM as it is supplied all these characters appear as a reverse video rectangle (all pixels hex FF, ie "1"s.)

Front Panel Switch S3

If this has been connected to pin assembly P2 (see "Alternative Use for S3" next if it hasn't) then S3 can be used to switch between two of the formats present in the Timing Generator EPROM used for position U3.

(The timing generator formats cover such items as the number of displayed lines on screen, whether or not they are interlaced, and so on) With the timing generator we supply at the time of writing the function of S3 also depends on the setting of DIL switch S1-8 (h):

Effect of S3 if S1-8 (h) is set ON

S3 Up 24 rows of 32 or 64 characters per row, non-interlaced, frame timebase 20 ms (50Hz), line timebase 64 us (15625 kHz).

S3 Down 25 rows of 32 or 64 characters per row, non-interlaced, frame timebase 20 ms (50Hz), line timebase 64 us (15625 kHz).

Effect of S3 if S1-8 (h) is set OFF

S3 Up 16 rows of 32 or 64 characters per row, non-interlaced, frame timebase 20 ms (50Hz), line timebase 64 us (15625 kHz).

S3 Down 24 rows of 32 or 64 characters per row, non-interlaced, frame timebase 20 ms (50Hz), line timebase 64 us (15625 kHz).

Alternative Use for S3

Of course the front panel switches can alternatively be connected to some other pin assemblies than the ones we specify. This would allow a particular user to switch some other parameter of the VDU-2K's design according to his own needs. For example, instead of connecting S3 to P2, S3 could be connected to P11. (Jumper links should be fitted to the pin assemblies left-terminated when a switch is used. This will be easy if the recommended wire wrapping

technique has been used to connect S3, not at all easy if it has been soldered.)

Operating S3 would then allow the choice between a 32 character and 64 character display to be made at the front panel of the computer.

SETTING UP

The only adjustment to make is the adjustment of the "no snow" circuit. (This is for cosmetic reasons only, to stop unpleasant speckling on the display when the VDU RAM is accessed by the CPU, the integrity of the data is not affected.)

No snow operation is only possible if the VDU-2K board can be used in a system with a 4 Mhz system clock or faster and if there is sufficient RAM in the system at the addresses to which the VDU-2K is to be set (usually F000H onwards). This last requirement implies that the jumpers on pin assemblies P3 and P7 should be shorting pins 1-2 in each case.

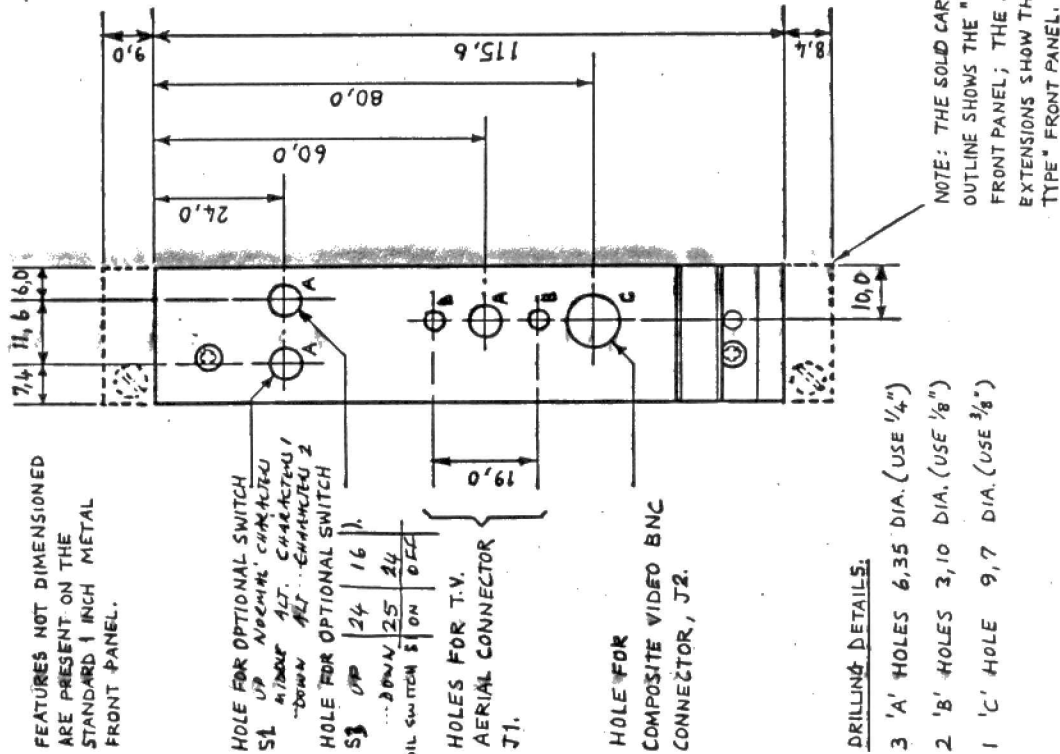
Enter and run this small program at some suitable address; 0800H is shown in the example below:

```
0800 3200F0 START: LD (F000H),A ;Write to the VDU
0803 18FB JR START ;and again and again
;and again and again
```

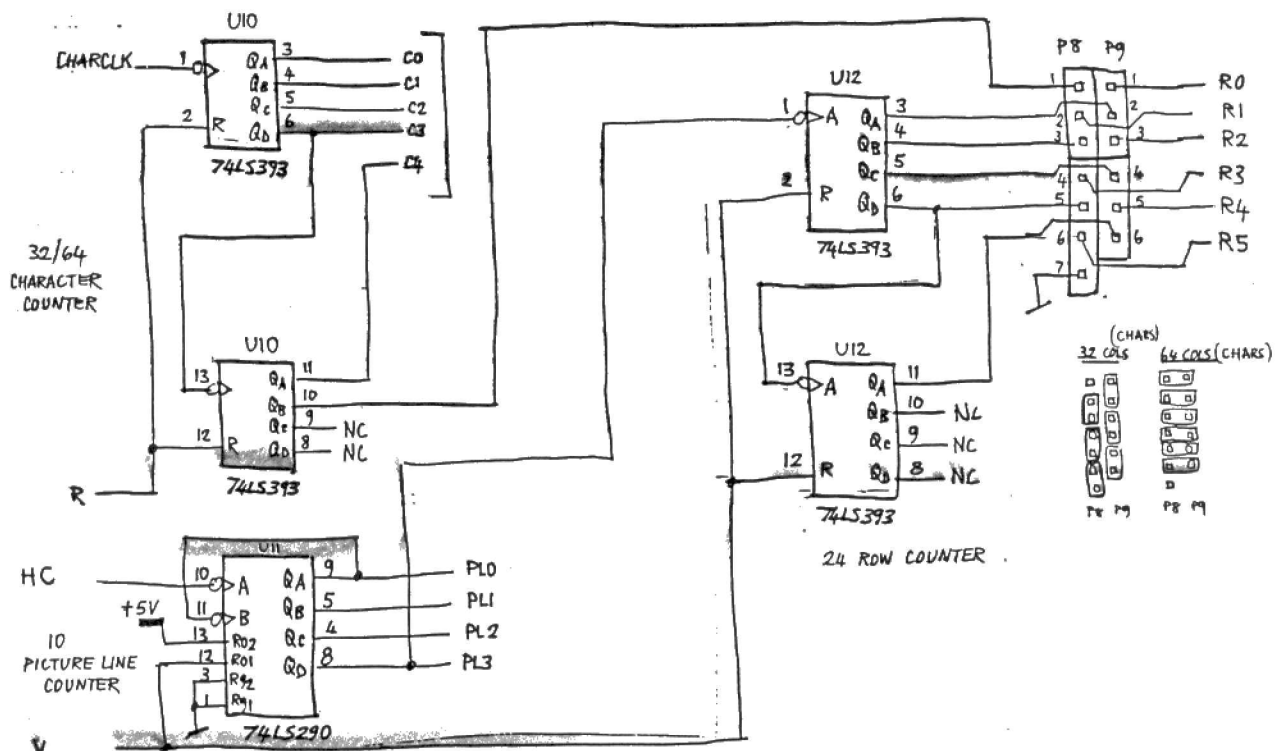
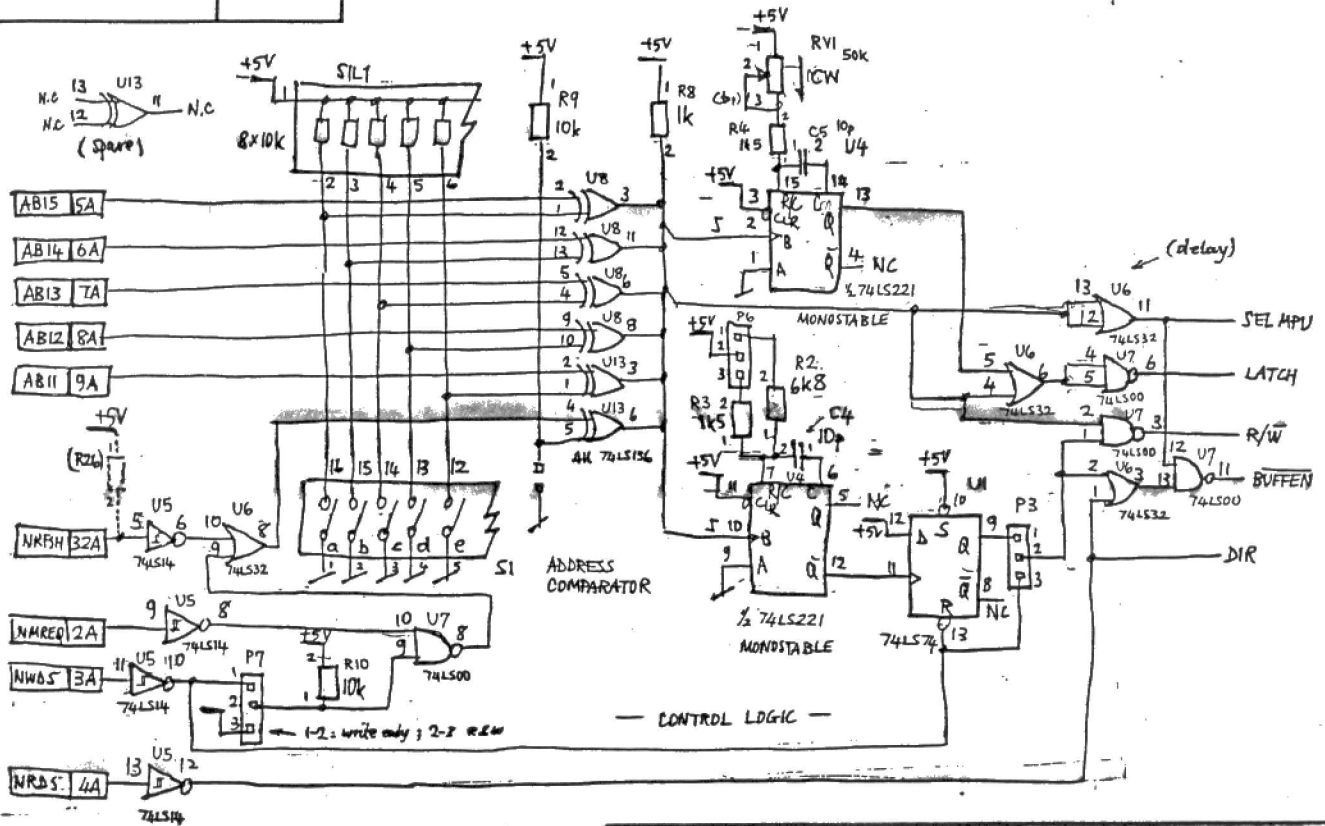
(Press reset when you have finished)

Adjust the variable resistor RV1 until a position is found where the disturbance on the screen is minimal. There should be a small range where there is no disturbance whatever; leave the variable resistor set in the middle of that range.

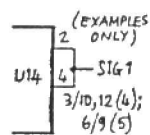
Note on use of Dynamic RAM Card type DRM-64: In a current Interak 1 disk system all 64K of RAM should be enabled. All elements of the two DIL switches on the DRM-64 card should therefore be OFF. (This enables RAM over the area of the on board firmware on the CPU card at E000H, but this is perfectly in order, as the "BUFFER" signal on the CPU card internal circuitry prevents any contention. The RAM which overlays the VDU at F000H also causes no problems, indeed its use is actively desirable to achieve the "no snow" operation.)



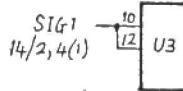
Modified 9.5.88 to show 'New Type' Panel dims.	Drawn D.M.P.	Interak
	Date 17-11-86	VDU-2K FRONT PANEL DRILLING ETC.
	Scale 1:1	DETAILS.
	Dims. mm	1 OF 1



KEY TO SYMBOLS USED ON CIRCUIT DIAGRAMS



OUTPUT PINS 2 AND 4 OF U14 PRODUCE A SIGNAL CALLED SIG1, WHICH IS CONNECTED TO U3 PINS 10, 12 (SHEET 4); AND U6 PIN 9 (SHEET 5).



INPUT PINS 10 AND 12 OF U3 RECEIVE A SIGNAL CALLED SIG1 WHOSE SOURCE IS U14 PINS 2, 4 (SHEET 1).



0.1" PITCH EDGE CONNECTOR POSITION EG. A2 IS SIDE A, PIN2; B3 IS SIDE B PIN3, ETC. BUS SIGNAL NAME.



CONNECTION PAD OR PIN.



POSITION WHERE TRACK MAY BE CUT FOR SOME SPECIAL PURPOSE; ALTERNATIVE CONNECTION SHOWN DOTTED.



WIRE LINK (EG. WIRE WRAPPED TO TERMINAL PINS) SHOWN SOLID. ALTERNATIVE POSITION SHOWN DOTTED.



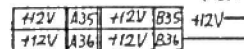
0V, EARTH CONNECTION.



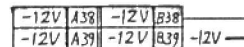
CONNECTION TO NAMED POWER SUPPLY RAIL.

POWER SUPPLIES

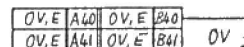
(EDGE CONNECTOR PINS A37, B37 REMOVED FOR POLARISING KEY)



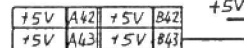
+12V NOT USED ON THIS CARD.



-12V NOT USED ON THIS CARD.



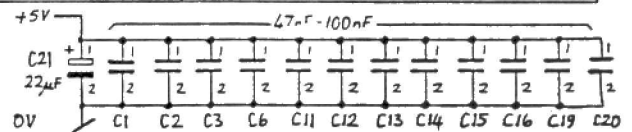
0V, EARTH POWER RAIL.



+5V POWER RAIL.

IC POWER SUPPLY CONNECTIONS ARE LISTED IN A TABLE IN ONE CORNER OF EACH SHEET OF THE MAIN CIRCUIT DIAGRAMS. FOR CLARITY OF LOGIC FLOW THE POWER SUPPLY CONNECTIONS ARE NOT NORMALLY INCLUDED ON THE GRAPHIC PART OF THE CIRCUIT DIAGRAMS. CONNECTIONS TO THE POWER SUPPLY RAILS FOR OTHER PURPOSES (E.G. ENABLES, DISABLES ETC.) ARE SHOWN.

DECOUPLING CAPACITORS



VDU-K Circuit Diagram
Adapted to VDU-2K 30/4/87
D.M.P.

Drawn D.M.P.

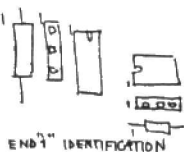
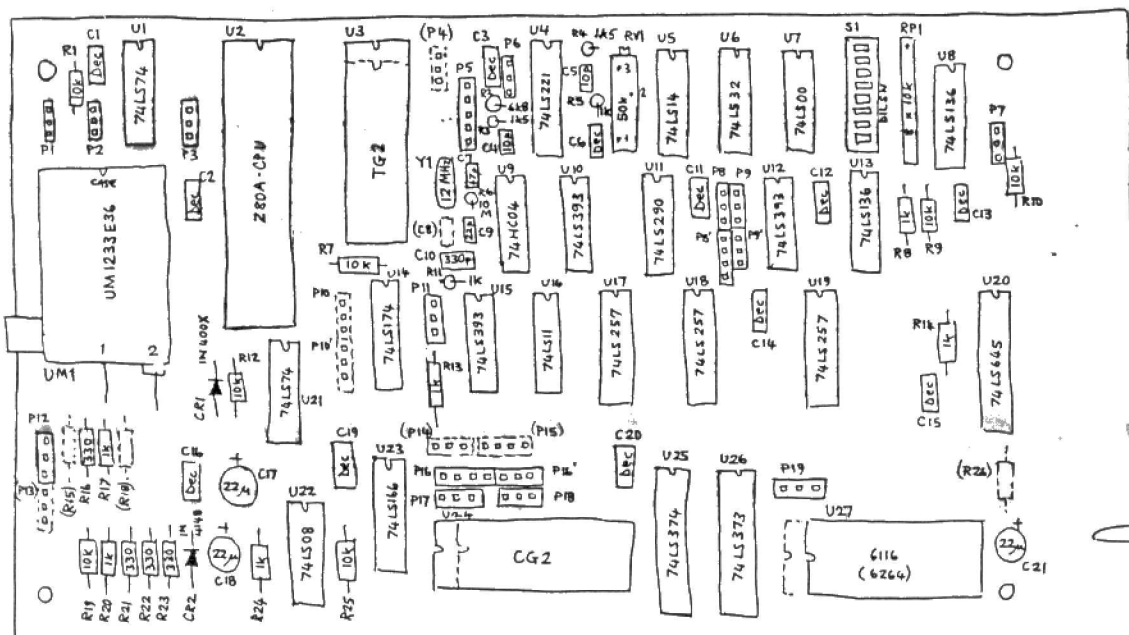
Date 9.11.82

Scale -

Interak

VDU-2K CIRCUIT DIAGRAM, SHEET 7:
KEY TO SYMBOLS, AND POWER
SUPPLIES

7 of 7



REDRAWN 6-5-86
Revised DMP
30/4/87

Drawn DMP

Date 19-12-85

Scale

Greenbank Electronics

VDU-2K Component Overlay
- new numbering

COMPONENT PARTS LIST FOR VDU-2K CARD

COMPONENT PARTS LIST FOR VDU-2K CARD (continued)

Issue 2

Date: December 1985

LISTED BY COMPONENT REFERENCE NUMBER

LISTED BY COMPONENT VALUE

PCB
1 off PCB VDU-2K

Resistors 0.25W (0.1" & 0.5" pitch)

R1	10k	0.5"	R14	1k	0.5"
R2	5k8	0.1"	R15	*	0.5"
R3	1k5	0.1"	R16	330R	0.5"
R4	1k5	0.1"	R17	1k	0.5"
R5	1k	0.1"	R18	*	0.5"
R6	10M	0.1"	R19	10k	0.5"
R7	10k	0.5"	R20	1k	0.5"
R8	1k	0.5"	R21	330R	0.5"
R9	10k	0.5"	R22	330R	0.5"
R10	10k	0.5"	R23	330R	0.5"
R11	1k	0.1"	R24	1k	0.5"
R12	10k	0.5"	R25	10k	0.5"
R13	1k	0.5"	R26	*	0.5"

* ("-" means not fitted)

SIL Resistor (Use Socket)

RPI 9-pin 8x10k

Variable Resistor (Multiturn Type)

RV1 50k

Capacitors

C1	Dec	0.2"	C12	Dec	0.2"
C2	Dec	0.2"	C13	Dec	0.2"
C3	Dec	0.2"	C14	Dec	0.2"
C4	10p	Cer	C15	Dec	0.2"
C5	10p	Cer	C16	Dec	0.2"
C6	Dec	0.2"	C17	22u	MAL
C7	47p	Cer	C18	22u	MAL
C8	*	0.1"	C19	Dec	0.2"
C9	22p	Cer	C20	Dec	0.2"
C10	330p	Cer	C21	22u	MAL
C11	Dec	0.2"	C22	22u	MAL

(C4,5 to be 5% tol, C7,9,10 can be the same)

* ("-" means not fitted)

Diodes

CR1 1N400X 0.5" CR2 1N4148 0.5"

1N 400X = 1N4001,2,3,4,5,6,7

Quartz Crystal

Y1 12.0 MHz

Date: December 1985

LISTED BY COMPONENT VALUE

PCB
1 off PCB VDU-2K

Resistors 0.25W

* -	3	R15,18,26
330R	4	R16,21,22,23
1k	8	R5,8,11,13,14,17,20,24
1k5	2	R3,4
6k8	1	R2
10k	7	R1,7,9,10,12,19,25
10M	1	R6
	23	(26)

* ("-" means not fitted)

SIL Resistor (Use Socket)

RPI 9-pin 8x10k

Variable Resistor (Multiturn)

50K 1 RW

Capacitors

* -	1	C8
10p	Cer	2 C4,5 (5% tolerance)
22p	Cer	1 C9
47p	Cer	1 C7
330p	Cer	1 C10
Dec	12	C1-3,6,11-16,19,20
22u	MAL	3 C17,18,21

"Cer" = Ceramic
 "Dec" = 47n-100n Decoupling grade polyester, or Ceramic
 "MAL" = Low Leakage Min. Aluminium

* ("-" means not fitted)

Diodes

1N400X 1 CR1 a + k

1N4148 1 CR2 a + k

1N 400X = 1N4001,2,3,4,5,6,7

Quartz Crystal

Y1 12.0 MHz

LISTED BY COMPONENT REFERENCE NUMBER

LISTED BY COMPONENT VALUE

Integrated Circuits (Use Sockets)

Integrated Circuits (Use Sockets)

U1	74LS74	(14)	U22	74LS08	(14)	6116/6264	1	U27
U2	280A-CPU	(40)	U23	74LS166	(16)	74HC04	1	U9
U3	TG2	(28)	U24	CG2	(28)	74LS00	1	U7
U4	74LS221	(16)	U25	74LS374	(20)	74LS08	1	U22
U5	74LS14	(14)	U26	74LS373	(20)	74LS11	1	U16
U6	74LS32	(14)	U27	6116/6264	(28)	74LS14	1	U5
U7	74LS00	(14)				74LS32	1	U6
U8	74LS136	(14)				74LS74	2	U1,21
U9	74HC04	(14)				74LS136	2	U8,13
U10	74LS393	(14)				74LS166	1	U23
U11	74LS290	(14)				74LS174	1	U14
U12	74LS393	(14)				74LS221	1	U4
U13	74LS136	(14)				74LS257	3	U17,18,19
U14	74LS174	(16)				74LS290	1	U11
U15	74LS393	(14)				74LS373	1	U26
U16	74LS11	(14)				74LS374	1	U25
U17	74LS257	(16)				74LS393	3	U10,12,15
U18	74LS257	(16)				74LS645	1	U20
U19	74LS257	(16)				CG2	1	U24
U20	74LS645	(20)				TG2	1	U3
U21	74LS74	(14)				Z80A-CPU	1	U2

DIL Switch (Use 16-pin DIL Socket)

DIL Switch (Use 16-pin DIL Socket)

S1 16-pin 8xSPST

16-pin 8xSPST 1 S1

0.1" Pitch Pin Assemblies

0.1" Pitch Pin Assemblies

P1	3-pin	P10	*	- (3-pin)	*	- (3-pin) 5	P4,10,10,13,14
P2	3-pin	P10	*	- (3-pin)	*	- (4-pin) 1	P15
P3	3-pin	P11	3-pin				
P4	*	- (3-pin)	P12	3-pin			
P5	5-pin	P13	*	- (3-pin)			
P6	3-pin	P14	*	- (3-pin)			
P7	3-pin	P15	*	- (4-pin)			
P8	3-pin	P16	4-pin				
P8	4-pin	P16	3-pin				
P9	3-pin	P17	3-pin				
P9	3-pin	P18	3-pin				
P9	3-pin	P19	3-pin				

* ("-" means not fitted)

UHF Modulator

UHF Modulator

UM1 UM1233E36 Wide Bandwidth

UM1 UM1233E36 1 UM1

COMPONENT PARTS LIST FOR VDU-2K CARD (continued)

DIL & SIL Sockets (29)

9-pin	1	RP1		20-pin	3	U20,25,26
14-pin	14	U1,5-13,15,16,21,22		28-pin	3	U3,24,27
16-pin	7	S1;U4,14,17-19,23		40-pin	1	U2

Sundry

18 off Push fit 0.1" pitch Jumper Links ("Jlinks")

Pre-stripped Insulated Wire (Including some spares)
10 off 38mm (for wiring front panel components)

Silicone Rubber Sleeveing (Including spare)
2 off 20mm x 1.5mm dia. precut (UHF Modulator output insulation)
1 off Tinned copper wire 24 swg (for connecting J1) 75mm

1 off Solder Tag (for connecting J1)

Extension Screening Piece for UHF Output
1 off 20mm long x 10mm dia.

Front Panel Switches

1 off S2 Front Panel mounted Min. Toggle SPDT 3-position Centre Off
1 off S3 Front Panel mounted Min. Toggle SPST

1 off Coaxial TV Aerial Connector J1

1 off BNC Video Connector and OV Tag J2

Card Front

1 off Kit (1 inch wide) including fixings and mounting brackets

M2.5 Fixings. (Generally Steel, "Supadriv")

2 off Screws 10mm Panhead (For fixing J1 to card front)
3 off Serrated Washers.
2 off Nuts.

E12 Resistor Colour Code (Ignore last band (generally gold))

330R Orange, Orange, Brown
1k Brown, Black, Red
1k5 Brown, Green, Red
6k8 Blue, Grey, Red
10k Brown, Black, Orange
10M Brown, Black, Blue